

A record of a landbird (Telluraves) from the Eocene Ikovo locality (East Ukraine)

Evgeniy ZVONOK and Leonid GOROBETS

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Abstract. First remains of a landbird from the Eocene (Lutetian) marine deposits of the Ikovo locality in Ukraine are described here. These include a single coracoid bone of an immature individual. The coracoid exhibits a combination of traits that is unknown in other species of birds. However, a more complete individual is required to decide if there is a new species of extinct bird. The described specimen exhibits traits comparable to those of the Telluraves clade and is most similar to the Eocene leptosomid *Plesiocathartes*.

Key words: Lutetian, Ukraine, Telluraves, coracoid, *Plesiocathartes*.

✉ Evgeniy ZVONOK, Taras Shevchenko University, Department of Geography, Oboronnaya st. 2, Luhansk 91011, Ukraine.

E-mail: evgenij-zvonok@yandex.ru

Leonid GOROBETS, National Museum of Natural History at the National Academy of Sciences of Ukraine, Department of Paleontology, Bohdan Khmelnytsky st. 15, Kyiv 199034, Ukraine; Taras Shevchenko National University of Kyiv, Department of Ecology and Environmental Protection, Volodymyrska st. 64/13, Kyiv 01601, Ukraine.

E-mail: ornitologist@gmail.com

I. INTRODUCTION

The assemblage of birds from the Ikovo locality, Luhansk Region, Ukraine (49°31'42" N, 39°3'59.5" E; lower Lutetian; Fig. 1) yielded several specimens of four marine species: two pelagornithids – *Lutetodontopteryx tethyensis* MAYR et ZVONOK, 2012 and *Dasornis* sp./ *Gigantornis* sp., the gaviiform *Colymbiculus udovichenkoi* MAYR et ZVONOK, 2011 and the possible procellariiform *Kievornis* sp. (MAYR & ZVONOK 2011, 2012; MAYR et al. 2013; ZVONOK et al. 2015). Continental birds from the Ikovo locality are rare and are represented by gruiform- and galliform-like individuals, which are known from a single specimen each (MAYR & ZVONOK 2011, 2012).

In this paper we describe an unusual coracoid of a medium-sized bird. Morphology of the coracoid resembles that of arboreal landbirds (Telluraves YURI et al. 2013) but it differs from the known taxa of the group by several anatomic details. The new specimen adds to the diversity of extinct birds from Ikovo.

Coracoids of extant birds from the collections of the Department of Vertebrate Palaeozoology of the National Museum of Natural History at the National Academy of Sciences

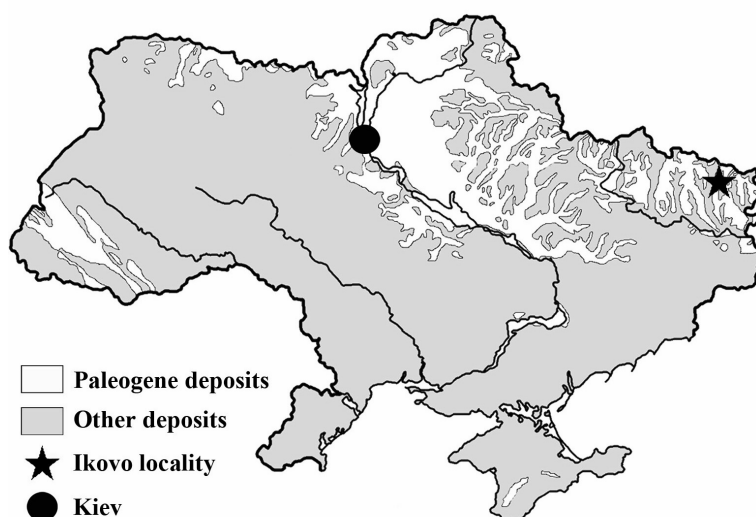


Fig. 1. The map of Paleogene deposits of Ukraine with Ikovo locality (based on NALIVKIN and SOKOLOV 1983).

of Ukraine were used for comparisons. The osteological terminology follows that by BAUMEL & WITMER (1993). We follow the concept of Telluraves (Passeriformes + Psittaciformes + Falconiformes + Cariamiformes + Coraciiformes + Piciformes + Bucerotiformes + Trogoniformes + Leptosomiformes + Coliiformes + Strigiformes + Accipitriformes) by YURI et al. (2013), and that of Eucavitates (Trogoniformes + Bucerotiformes + Coraciiformes + Piciformes) by KIMBALL et al. (2013).

The specimen was found in a bone-bearing layer (Fig. 2) in a ravine slope of Ikovo locality together with numerous bones of other birds, reptiles and fishes. A lower Lutetian age of the sediments is indicated by the selachian assemblage of zone E10, according to UDOVICHENKO (2009).

Institutional abbreviations. NMNHU-P – Department of Vertebrate Palaeozoology of the National Museum of Natural History at the National Academy of Sciences of Ukraine, Kyiv, Ukraine; BMNH – Natural History Museum, London, UK; MHNT – Museu Historia Natural do Taubaté, Sao Paulo, Brazil; WDC – Wyoming Dinosaur Center, Thermopolis, USA.

II. DESCRIPTION AND COMPARISON

The specimen NMNHU-P Av-46 (Figs 3, 4A) represents a left coracoid lacking the processus medialis of the extremitas sternalis, and shows a ?postmortem perforation of the facies articularis clavicularis. The mid-line length of the coracoid is 25 mm, the maximum length – 27.3 mm, the length of the dorsal epiphysis (KUROCHKIN 1979) – 6.5 mm, and the minimal transverse width of the shaft – 2.3 mm. The bone surface is porous, in particular on the both extremitates, indicating a subadult age of the specimen. The extremitas omalis has a slight medial deflection, as in the Ypresian-Lutetian leptosomiform *Plesiocathartes*

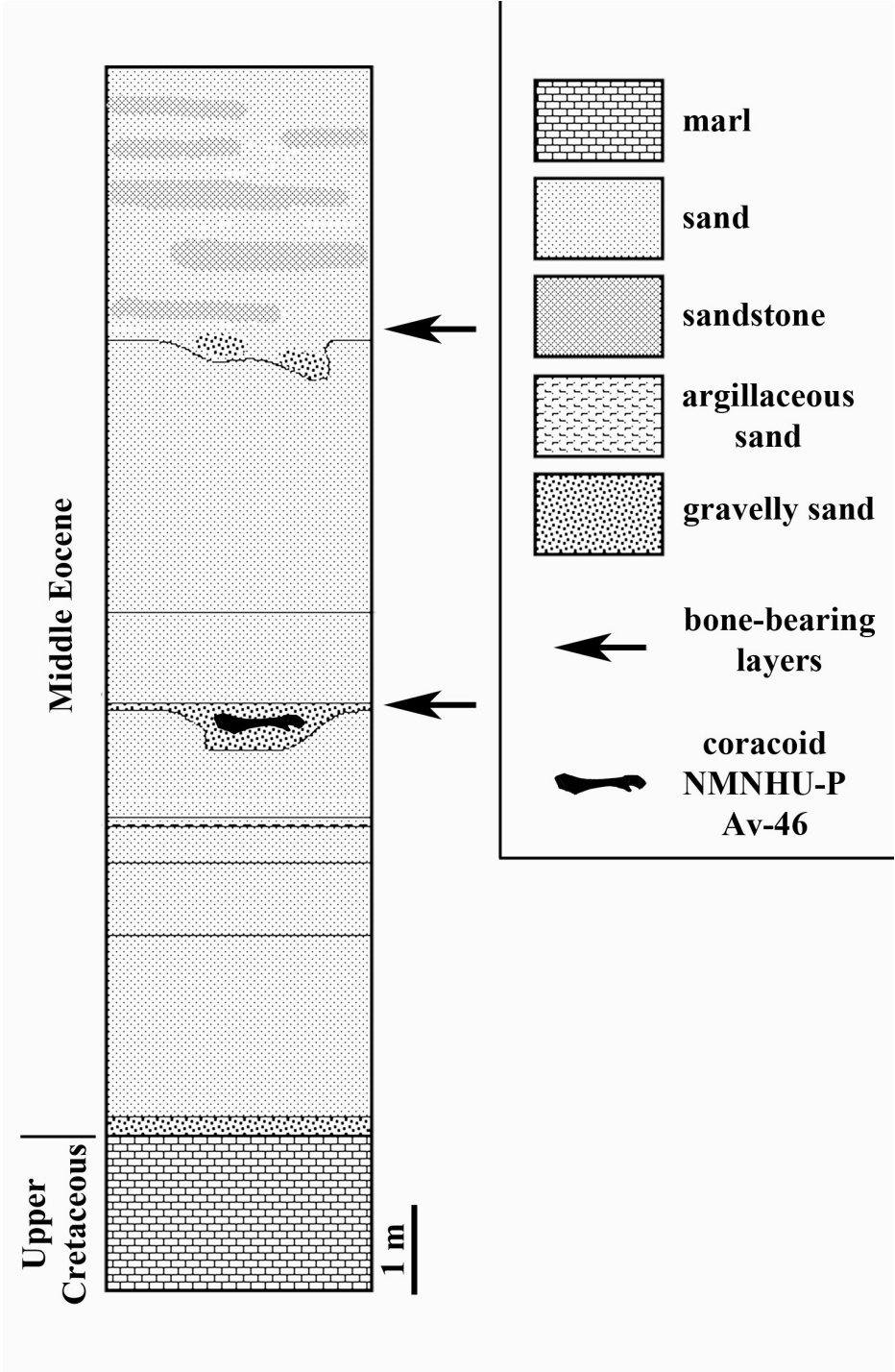


Fig. 2. Sedimentologic profile of Ikovo locality (based on UDOVICHENKO 2009).

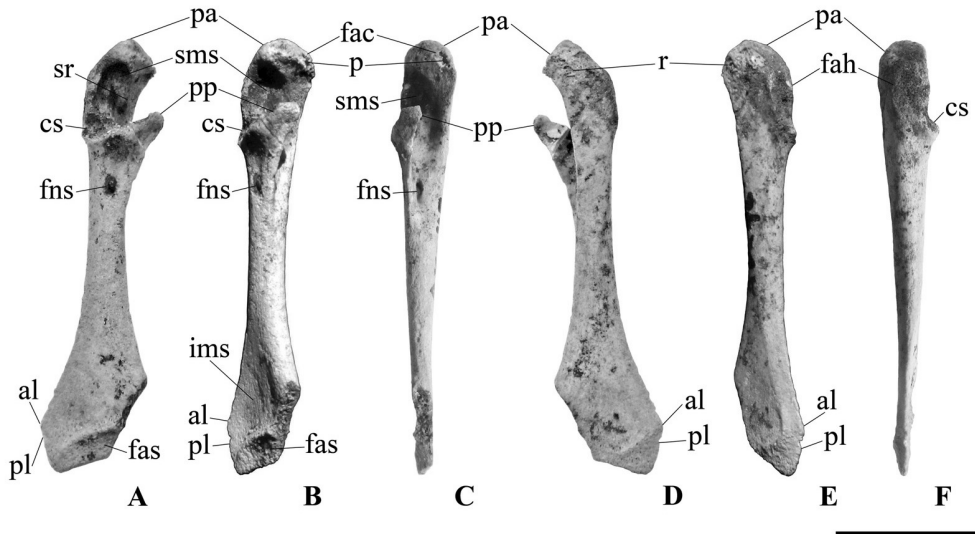


Fig. 3. Coracoid of NMNHU-P Av-46 in dorsal (A), dorsomedial (B), medial (C), ventral (D), ventrolateral (E) and lateral (F) views. **Abbreviations:** al – angulus lateralis, cs – cotyla scapularis, fac – facies articularis clavicul-
ularis, fah – facies articularis humeralis, fas – facies articularis sternalis, fns – foramen nervi supracoracoidei, im-
s – impressio musculi sternocoracoidei, p – perforation in the facies articularis clavicularis, pa – processus
acroracoideus, pl – processus lateralis, pp – processus procoracoideus, r – rugosity on the ventral surface of
the extremitas omalis, sms – sulcus musculi supracoracoidei, sr – sharp rim bordered depression on the sulcus
supracoracoideus. Scale bar – 1 cm.

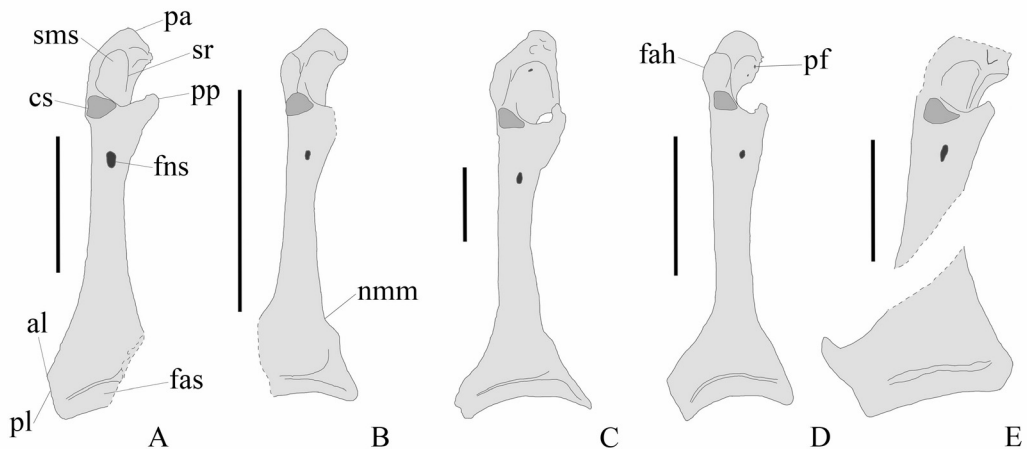


Fig. 4. Left coracoids of NMNHU-P Av-46 and selected taxa in dorsal view. A: *Telluraves* indet. NMNHU-P
Av-46; B: *Halcyornithidae* indet. BMNH A 6218 (redrawn and mirrored from MAYR 2002: fig. 4A); C: *Mi-
crastur semitorquatus* MHNT 1463 (redrawn from JONES et al. 2013: fig. 6/7); D: *Aegolius funereus*
NMNHU-P 109-22-2; E: *Plesiothartes major* WDC-2001-CGR-022 (redrawn from MAYR 2008: fig. 2A).
Most abbreviations as in Fig. 3; additional abbreviations: nmm – notch at the margo medialis of extremitas
sternalis, pf – pneumatic foramen. Scale bar – 1 cm.

GAILLARD, 1908 (Fig. 4E; MAYR 2008: fig. 2A, C). It is not pneumatized, unlike in birds of prey: Accipitriformes, Falconiformes and Strigiformes (except Tytonidae; Fig. 4C, D). The facies articularis clavicularis is present, while it is absent in Tytonidae and the Ypresian-Lutetian psittaciform Messelasturidae (MAYR 2005b). The facies does not expand, contrasting with conditions in Falconiformes and extant Psittaciformes (KSEPKA et al. 2011). The sulcus supracoracoideus has a deep depression which is medially bordered by a sharp rim, like in *Plesiocathartes* (Fig. 4E; MAYR 2008: fig. 2A, C). The facies articularis humeralis is oriented laterally and slightly elevated above the shaft in dorsal view. The cotyla scapularis is shallow, unlike in Accipitriformes (except *Pandion*), Leptosomiformes and Messelasturidae (MAYR 2005b, 2008). The processus procoracoideus is long and curved, unlike in Accipitriformes, with the possible exception of the Priabonian accipitriform *Horusornis* (MOURER-CHAUVIRÉ 1991). The shaft is moderately slender. The foramen nervi supracoracoidei is large and in dorsal view it is located roughly in the midline of the shaft, unlike in Accipitriformes (except *Sagittarius*) and some Falconidae, in which the foramen nervi supracoracoidei is shifted medially. The extremitas sternalis is thin and straight in medial and lateral view. The transition between the shaft and the processus lateralis as well as between the shaft and the preserved part of the processus medialis is gradual, without notches or projections, which contrasts with conditions in the Ypresian-Lutetian cypselomorph Fluvioviridavidae, the Ypresian-Lutetian psittaciform Halcyornithidae, and some Coraciimorphae (Fig. 4B; MAYR & DANIELS 2001; MAYR 2002, 2004; CLARKE et al. 2009). The processus lateralis is reduced and has an obtuse angulus lateralis, like in Falconidae and Strigidae (Fig. 4C, D). The impressio musculi sternocoracoidei is very shallow and has no pneumatic foramina, unlike in Cathartidae (MAYR 2005b). The facies articularis sternalis is not widening, unlike in Bucerotiformes (MAYR 2004).

III. DISCUSSION

The specimen described here most closely resembles some Cypselomorphae (Fluvioviridavidae), Telluraves (*Plesiocathartes*, Falconidae, Halcyornithidae and Strigiformes), and Aves *incertae sedis* (Ypresian *Eocolius* DYKE et WATERHOUSE, 2001 and *Lapillavis* MAYR, 2016). It is similar to the coracoid of *Eocolius*, which was originally described as a coliform, but is now placed in Aves *incertae sedis* (DYKE & WATERHOUSE 2001; KSEPKA & CLARKE 2009). *Eocolius* is smaller than NMNHU-P Av46 (length: 18.4 mm), and further differs from it in the presence of a brachial tuberosity (DYKE & WATERHOUSE 2001). *Lapillavis* is another bird with uncertain taxonomic affinity that closely resembles our specimen, but it differs from the latter in size (it is smaller judging from the image in MAYR 2016: fig. 2D) and several anatomic characters such as a cup-like cotyla scapularis, a far sternally situated foramen nervi supracoracoidei and, possibly, a longer processus lateralis (MAYR 2016). The similarities to *Eocolius* and *Lapillavis*, however, do not clarify taxonomic identity of NMNHU-P Av-46.

Although some similarity exists between this specimen and the Fluvioviridavidae, the latter significantly differ in having a cup-like cotyla scapularis, shallow indentation on the medial margin of the shaft, and a spur-like angulus lateralis (MAYR & DANIELS 2001; MAYR 2005a).

In consequence of the comparison above we have found it reasonable to place NMNHU-P Av-46 within clade Telluraves.

The evolution of Telluraves is characterized by numerous parallelisms in coracoid shape. This complicates the diagnosis of coracoids of fossil representatives of this clade. Below we present a summary of distribution of most distinct coracoid traits in arboreal landbirds which can be used to clarify the systematic position of our specimen.

Presence of foramen nervi supracoracoidei. The presence of this foramen most likely is a plesiomorphic trait of arboreal landbirds (MAYR 2008). The foramen is present in NMNHU-P Av-46. This condition is also known in Halcyornithidae and Messelasturidae (Psittaciformes), Leptosomiformes, *Oblitavis* MOURER-CHAUVIRÉ, 1983 (Cariamiformes) from an unknown horizon of Quercy fissure fillings, the Ypresian-Lutetian Sandcoleidae (Coliiformes), Strigiformes, and some Accipitriformes and Falconiformes among Telluraves (MAYR 2002, 2008, 2009, 2011; MAYR & CLARKE 2003; KSEPKA & CLARKE 2009).

Shallow cotyla scapularis. A shallow cotyla scapularis likely represents a synapomorphy of arboreal landbirds, contrasting with a cup-like cotyla scapularis that presumably is a plesiomorphic character (see MAYR 2008; KSEPKA & CLARKE 2012). The shallow cotyla scapularis is present in all Passeriformes, Coliiformes, Falconiformes, Strigiformes, Cariamiformes and Eucavitates, and in some Psittaciformes (all excluding some Eocene species) and Accipitriformes (*Pandion*; MAYR 2002, 2008, 2009, 2011; KSEPKA & CLARKE 2012).

Absence of pneumatic foramina on the underside of the processus acrocoracoideus. This is likely a plesiomorphic trait of arboreal landbirds, because these pneumatic foramina are absent in most Telluraves and appear in Strigiformes and Psittaciformes only later in evolution (MAYR 2002, 2009). The foramina are present in Falconiformes, Accipitriformes, and in some taxa of Coraciiformes, Passeriformes, Psittaciformes, and Strigiformes (MAYR 2002, 2009; KSEPKA & CLARKE 2012).

Long, curved processus procoracoideus. It is likely a plesiomorphic trait as it is present in most representatives of the clade of arboreal landbirds. The trait is absent only in some Coraciiformes, Piciformes, Passeriformes, Coliiformes, Cariamiformes, and all Accipitriformes (except, possibly, *Horusornis*; MOURER-CHAUVIRÉ 1991; MAYR 2004, 2005b, 2011; WEIDIG 2006; KSEPKA & CLARKE 2009).

NMNHU-P Av-46 shows one conspicuous trait – a reduced processus lateralis of the extremitas sternalis. Shape of the processus lateralis differs within Coraciiformes, Passeriformes and Piciformes. The reduced processus lateralis did not occur early in evolution of Strigiformes and Coliiformes (KSEPKA & CLARKE 2009). A reversed sequence of appearance of this trait can be assumed for Trogoniformes as early members (Rupelian *Primotrogon* MAYR, 1999) show a short, obtuse processus lateralis, whereas late members show an elongate process (MAYR 1999). In conclusion, the phylogenetic nature of both states remains unclear.

NMNHU-P Av-46 lacks the following traits: impressio musculi sternocoracoidei on dorsal surface of extremitas sternalis with pneumatic foramina (Cathartidae; MAYR 2005b), wider facies articularis sternalis (Bucerotiformes; MAYR 2004), notched margo medialis of extremitas sternalis (Halcyornithidae and some Coraciimorphae, including all

Piciformes; MAYR 2002, 2004; CLARKE et al. 2009). On the other hand, it possesses the foramen nervi supracoracoidei, shallow cotyla scapularis, no pneumatic foramina in the medial portion of the processus acrocoracoideus, long and curved processus procoracoideus, and reduced processus lateralis of the extremitas sternalis. This peculiar combination of traits is only present in two early diverging families of Telluraves clade: the Eocene Halcyornithidae (Psittaciformes) and the Eocene-to-extant Tytonidae (Strigiformes). However, these taxa differ in other features from NMNHU-P Av-46. Halcyornithidae have a spur-like angulus lateralis and margo medialis, with a notched extremitas sternalis (MAYR & DANIELS 1998: fig. 17b; MAYR 2002; KSEPKA et al. 2011: fig. 4.5). Tytonidae differ in having a wider processus procoracoideus (MOURER-CHAUVIRÉ 1987; MAYR 2009). There are also similarities to Falconidae and Strigidae in this combination of traits, except the fact that representatives of these families show pneumatic foramina in the medial portion of the processus acrocoracoideus. Also, both Falconidae and Strigidae differ from NMNHU-P Av-46 in a lesser degree of the medial deflection of the extremitas omalis.

In summary, the specimen from Ikovo is most similar to *Plesiocathartes*, especially by the extremitas omalis, which appears to be nearly identical in shape (Fig. 4E; MAYR 2008: fig. 2A). However, it bears two traits that are unusual for Leptosomiformes (*Plesiocathartes* + *Leptosomus*): the shallow cotyla scapularis and the short processus lateralis of extremitas sternalis. Although the cotyla scapularis of *Plesiocathartes* is deep, its shape is subtriangular, like in NMNHU-P Av-46 (MAYR 2008: fig. 2A, C). The processus lateralis of *Plesiocathartes* is more elongated than in NMNHU-P Av-46, but other details look alike (MAYR 2008: fig. 2A, C).

Based on these findings, we can only identify NMNHU-P Av-46 as an arboreal landbird (Telluraves), most probably closely related to Leptosomiformes.

IV. CONCLUSIONS

The new specimen is the first representative of Telluraves clade from the Ikovo locality. NMNHU-P Av-46 combines the features which are not characteristic of any taxa that refer to Telluraves. So it is reasonable to assume that the coracoid NMNHU-P Av-46 may belong to a new taxon. However, the specimen is too incomplete and not fully matured to provide a solid base revealing phylogenetic position of this Ikovo bird. This can only be clarified through new finds of more complete skeletal elements of this and contemporaneous arboreal landbirds. Unfortunately, comparisons are aggravated due to some other reasons, for example because the coracoids of Eocene falconids are unknown, or are poorly preserved in their possible Middle Eocene relative *Masillaraptor*, and because fossils of possible relatives of *Plesiocathartes* have not been described yet (MAYR 2009; G. MAYR, pers. comm.).

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